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(54) CIRCUIT BOARD

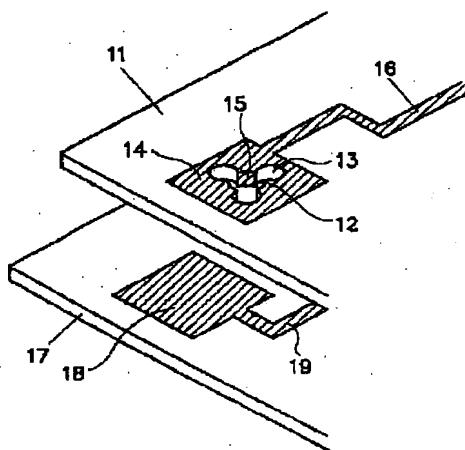
(57) Abstract:

PROBLEM TO BE SOLVED: To enable observation of whether a first circuit board and a second circuit board are surely fastened to each other, even after the first and the second circuit board have been conductively fastened with solder filled in a through-hole.

SOLUTION: A circuit board is provided with a first circuit board 11 which has a through-hole that passes through the board and has a through-hole conductor 15, constituted of a conductive film formed in the periphery of the through-hole and a second circuit board 17 which has a land electrode 18, formed in correspondence with the through-hole 12. In the first circuit board 11, a through-hole 13 for visual observation is formed continuously with the through-hole 12. A conductive film is not formed on an inner wall of the through-hole 13 for visual observation and a conductive binder will not stick to the inner wall of the through-hole 13. The first circuit board 11 is mounted on the second circuit board 17 to conductively fasten the through-hole conductor 15 of the first circuit board 11 to the land electrode 18 on the second circuit board 17. Under this condition, the fastened state of the solder 20 can be

observed visually via the through-hole 13.

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**Notes:**

1. Untranslatable words are replaced with asterisks (\*\*\*\*).
2. Texts in the figures are not translated and shown as it is.

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## CLAIMS

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**[Claim(s)]**

**[Claim 1]** having the through hole (12) which penetrates a substrate -- the peripheral surface -- a conductor -- [ circuit board / first / in which through hole conductor (15) which consists of film was formed / (11) ] It has the second circuit board (17) by which the land electrode (18) was formed on the surface corresponding to said through hole (12). In the circuit board which carried the first circuit board (11) in the second circuit board (17), and carried out electric conduction fixing of the through hole conductor (15) of the first circuit board (11) at the land electrode (18) on the second circuit board (17) The circuit board characterized by having put it in a row to the through hole (12), and forming the through hole for visual observation (13) in the first circuit board (11).

**[Claim 2]** the peripheral wall of the through hole for visual observation (13) -- a conductor -- the circuit board according to claim 1 characterized by not forming the film but this peripheral wall serving as a wall surface to which an electric conduction fixing material does not adhere.

**[Claim 3]** The circuit board according to claim 1 characterized by establishing two or more through holes for visual observation (13) in the perimeter of the through hole (12) which has a through hole conductor (15).

**[Claim 4]** The circuit board according to claim 1 characterized by the through hole for visual observation (13) being larger than the through hole (12) which has a through hole conductor (15).

**[Claim 5]** a rear face -- a conductor -- [ circuit board / first / in which land electrode (21) which consists of film was formed / (11) ] It has the second circuit board (17) by which the land electrode (18) was formed on the surface corresponding to said land electrode (21). In the circuit board which carried the first circuit board (11) in the second circuit board (17), and carried out electric conduction fixing of the land electrode (21) of the first circuit board (17) at the land electrode (18) on the second circuit board (17) The circuit board characterized by having adjoined the land electrode (21) of the rear face of the first circuit board (11), and forming the through hole for visual observation (13).

**[Claim 6]** the peripheral wall of the through hole for visual observation (13) -- a conductor -- the circuit board according to claim 5 characterized by not forming the film but this peripheral wall serving as a wall surface to which an electric conduction fixing material does not adhere.

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## DETAILED DESCRIPTION

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**[Detailed Description of the Invention]**

[0001]

[Field of the Invention] This invention relates to the circuit board which carried out electric conduction fixing of the two circuit boards with solder or electroconductive glue. For example, soldering of the through hole conductor of the first circuit board is carried out to the land electrode of the second circuit board, or it is related with the circuit board which carried out soldering of the land electrode formed in the rear face of the first circuit board to the land electrode of the second circuit board.

[0002]

[Description of the Prior Art] Drawing 8 and drawing 9 carry out electric conduction fixing of the two circuit boards using a through hole conductor. a through hole 2 is formed in the first circuit board 1 -- the peripheral wall of the through hole 2 -- a conductor -- while the through hole conductor 5 which consists of film is formed -- the perimeter of the through hole 2 of rear surface both sides of the first circuit board 1 -- a conductor -- the land electrode 4 which consists of film is formed. Furthermore, the circuit pattern 6 for connecting the through hole conductor 5 with other circuit parts electrically is formed in the land electrode 4. On the other hand, the land electrode 8 is formed in said through hole 2 on the surface of the second circuit board 7, and the corresponding location.

[0003] It fills up with paste solder in the through hole 2 of the first circuit board 1, and the first circuit board 1 is carried on the second circuit board 7 in this state. And a reflow of said paste solder is carried out, and by re-hardening, as shown in drawing 2 , soldering of the through hole conductor 5 of the first circuit board 1 is carried out to the land electrode 8 of the second circuit board 7. Thereby, the circuit pattern formed in the first circuit board 1 and the circuit pattern formed in the second circuit board 7 are connected through the solder 9 in said through hole 2. Moreover, it may solder to the land electrode which formed the land electrode in the other rear faces of the first circuit board, and formed this land electrode in the surface of the second circuit board.

[0004]

[Problem(s) to be Solved by the Invention] By the circuit board 1 of two sheets, and the thing which connects 7, the through hole conductor 5 of the first circuit board 1 and the land electrode 8 of the second circuit board 7 are connected through a through hole 2 like the former by the solder 9 with which it was filled up in the through hole 2. However, since solder 9 will be filled up with this state in the through hole 2 of the first circuit board 1 as shown in drawing 2 , the bond part of this solder 9 and the land electrode 8 of the second circuit board 7 will hide with solder 9. For this reason, visual observation of whether the through hole conductor 5 of the first circuit board 1 and the land electrode 8 of the second circuit board 7 are soldered certainly cannot be carried out.

[0005] Furthermore, visual observation of whether also by the circuit board like the latter, since a land electrode is soldered between the two circuit boards, the amount of [ of the land electrode of the two circuit boards ] bond part hides, and the land electrode of the two circuit boards is certainly soldered by the circuit board cannot be carried out. For this reason, it was difficult to secure the dependability after soldering. This is also the same as when connecting the through hole and land electrode of the two circuit boards with electroconductive glue. It aims at enabling it to observe easily whether the part which the two circuit boards should carry out electric conduction fixing in view of the technical problem in such the conventional circuit board certainly fixes this invention also after fixing.

[0006]

[Means for solving problem] In this invention, in order to attain this object, it is put in a row to the through hole 12 of the first circuit board 11. or the land electrode 21 of the rear face of the first circuit

board 11 is adjoined, the through hole 13 for visual observation is formed, and neither solder nor electroconductive glue adheres to the through hole 13 further for this visual observation -- as -- a conductor -- the film was formed. Thereby, it lets a through hole 13 pass and could be made to carry out visual observation of the fixing state by solder etc.

[0007] namely, -- the circuit board by this invention has the through hole 12 which penetrates a substrate -- the peripheral surface -- a conductor -- [ circuit board / in which through hole conductor 15 which consists of film was formed / 11 / first ] It has the second circuit board 17 by which the land electrode 18 was formed on the surface corresponding to said through hole 12. Carry the first circuit board 11 in the second circuit board 17, and electric conduction fixing of the through hole conductor 15 of the first circuit board 11 is carried out at the land electrode 18 on the second circuit board 17. It is characterized by having put it in a row to the through hole 12, and forming the through hole 13 for visual observation in the first circuit board 11. and -- the peripheral wall of the through hole 13 for this visual observation -- a conductor -- the film is not formed but let this peripheral wall be the wall surface to which an electric conduction fixing material does not adhere.

[0008] stand in a row in the through hole 12 where fixing members, such as solder of the first circuit board 11 and electroconductive glue, are filled up with such the circuit board, and the through hole 13 for visual observation is formed -- there -- a conductor -- there is no film and solder etc. does not adhere. For this reason, a through hole 12 is filled up with solder etc. and fixing states, such as a potato, the through hole conductor 15 of that first circuit board 11, and solder to the land electrode 18 of the second circuit board 17, can carry out visual observation through a through hole 13.

[0009] Therefore, if two or more through holes 13 for visual observation are established in the perimeter of the through hole 12 which has the through hole conductor 15, fixing states, such as the aforementioned solder, can check from two or more directions. Moreover, if the through hole 13 for visual observation is larger than the through hole 12 which has the through hole conductor 15, the fixing state can carry out visual observation also of the small solder easily.

[0010] furthermore, other circuit boards by this invention -- a rear face -- a conductor -- [ circuit board / in which land electrode 21 which consists of film was formed / 11 / first ] It has the second circuit board 17 by which the land electrode 18 was formed on the surface corresponding to said land electrode 21. The first circuit board 11 is carried on the second circuit board 17, electric conduction fixing of the land electrode 21 of the rear face of the first circuit board 11 is carried out at the land electrode 18 on the second circuit board 17, and it is characterized by having adjoined the land electrode 21 of the first circuit board 11, and forming a through hole 13. and -- the peripheral wall of the through hole 13 too for this visual observation -- a conductor -- the film is not formed but let this peripheral wall be the wall surface to which an electric conduction fixing material does not adhere.

[0011] also in this circuit board, adjoin the land electrode 21 of the rear face of the first circuit board 11, and the through hole 13 is formed -- there -- a conductor -- there is no film and solder etc. does not adhere. For this reason, the fixing state of the land electrode 21 of the first circuit board 11 and the land electrode 18 of the second circuit board 17 can carry out visual observation through a through hole 13.

[0012]

[Mode for carrying out the invention] Next, it explains to concrete about the gestalt of operation of this invention, and a detail, referring to Drawings. Drawing 1 , drawing 2 , and drawing 3 are examples which carry out electric conduction fixing of the two circuit boards 11 and 17 using a through hole

conductor. The first circuit board 11 forms a circuit pattern in the surface and the interior of an insulating substrate which consist of an alumina, glass epoxy resin, etc. a through hole 12 is formed in this first circuit board 11 -- the peripheral wall of that through hole 12, and the perimeter of the through hole 12 of rear surface both sides of the first circuit board 11 -- a conductor -- the land electrode 14 which consists of film is formed. Furthermore, the circuit pattern 16 for connecting the through hole conductor 15 to this land electrode 14 in a circuit is formed.

[0013] It stands in a row in this through hole 12, and three through holes 13 for visual observation are formed in the perimeter of said through hole 12 at intervals of 120 degrees. the peripheral wall of the through hole 13 for this visual observation -- a conductor -- the film is not formed, but insulating coating is performed be [ it / the natural complexion of an insulating substrate / continue ]. on the other hand -- said through hole 12 on the surface of the second circuit board 17, and a corresponding location -- a conductor -- the land electrode 18 which consists of film is formed.

[0014] It fills up with the paste solder which is not illustrated in said through hole 12 of the first circuit board 11 shown in drawing 1 , and the first circuit board 11 is carried on the second circuit board 17 in this state. And a reflow of said paste solder is carried out, and by re-hardening, as shown in drawing 2 and drawing 3 , the through hole conductor 5 of the first circuit board 11 is soldered to the land electrode 18 of the second circuit board 17 with solder 20. Thereby, the circuit pattern formed in the first circuit board 11 and the circuit pattern formed in the second circuit board 17 are connected through the solder 20 in said through hole 12.

[0015] as shown in drawing 3 , solder 20 is filled up with this state into the through hole 12 of the first circuit board 1, but stand in a row in this through hole 12, and the through hole 13 for visual observation is formed -- there -- a conductor -- there is no film and solder 20 does not adhere. For this reason, whether the solder 20 with which the through hole 12 was filled up fixes in the through hole conductor 15 or the land electrode 18 of the second circuit board 17 can carry out visual observation through a through hole 13. Especially in the example shown in drawing 1 , drawing 2 , and drawing 3 , since two or more through holes 13 for visual observation are established in the perimeter of the through hole 12 by the equiangular distance, fixing states, such as the aforementioned solder, can check from two or more directions, and visual observation can carry out easily and certainly.

[0016] Such a through hole 12 and a through hole 13 can be formed, for example by the following methods. When an insulating substrate is a glass epoxy resin substrate, a drill, punch, etc. punch at a substrate the through hole 12 which forms the through hole conductor 15. next, the surface of the circuit board including the peripheral surface of this through hole 12 -- conductors, such as Cu, -- forming the film -- this conductor -- the film is patterned with means, such as photoetching. Then, a drill etc. punches the through hole 13 for visual observation at a substrate. Moreover, when an insulating substrate is an alumina substrate, a drill, punch, etc. punch at a substrate the through hole 12 which forms the through hole conductor 15. Next, conductive paste is screen-stenciled by a predetermined pattern on the surface of the circuit board including the peripheral surface of this through hole 12. Then, a drill etc. punches the through hole 13 for visual observation at a substrate, and conductive paste can be burned further.

[0017] Next, if the example shown in drawing 4 and drawing 5 is explained, in this example, it is put in a row to the through hole 12 in which the through hole conductor 15 was formed, and the through hole 13 for visual observation of the rectangle whose width is wider than the path of this through hole

12 is formed. this conductor -- the through hole 12 is mostly cut in the direction of a path by the through hole 13 which does not have the film, therefore a through hole 12 is a semicircle-like. In this example, since the through hole 13 for visual observation is large, even if the solder 20 in a through hole 12 is small, visual observation of that fixing state is easy.

[0018] Drawing 6 shows other examples of the configuration of the through hole 12 in which said through hole conductor 15 was formed, and the through hole 12 for visual observation. In the example shown in drawing 6 (a), it is put in a row to the through hole 12 in which the through hole conductor 15 was formed, and the through hole 13 for visual circular observation of a bigger path than the path of this through hole 12 is formed. Moreover, in the example shown in drawing 6 (b), it is put in a row to the through hole 12 in which the through hole conductor 15 was formed, and the through hole 13 for two visual circular observation of a bigger path than the path of this through hole 12 puts it in a row, and is prepared. Also in these examples, since the through hole 13 for visual observation is large, even if the solder 20 in a through hole 12 is small, visual observation of the fixing state is easy.

[0019] Furthermore, the example shown in drawing 7 is an example which soldered not a through hole conductor but the land electrode 21 established in the rear face of the first circuit board 11, and the land electrode 18 established in the surface of the second circuit board 17 with solder 20. The land electrode 21 of the first circuit board 11 is adjoined, and the through hole 13 for visual observation is formed. In such the circuit board, although the land electrode 18 and the soldering connection section of 21 are between the circuit board 17 of two sheets, and 18, the fixing state by the solder 21 of this part can carry out visual observation easily by the through hole 13 for said visual observation. In addition, although the above example showed the circuit board 11 of two sheets, and the example which connects the circuit of 17 with solder 20, even if it is connection by lower melting point metals and electroconductive glue other than solder, it is in \*\* that this invention is applicable similarly.

[0020]

[Effect of the Invention] [ the circuit board by this invention ] as explained above When the first, the second circuit board 11, and the circuit of 17 are connected by the solder 20 grade with which the through hole 12 of the first circuit board 11 was filled up The fixing state of the through hole conductor 15 of the first circuit board 11 or the solder 20 to the land electrode 18 grade of the second circuit board 17 can carry out visual observation through a through hole 13. Moreover, when it fixes with solder the land electrode 21 formed in the rear face of the first circuit board 11, and the land electrode 18 formed in the surface of the second circuit board 17, the fixing state can carry out visual observation through a through hole 13. Thus, since it is certainly observable whether the two circuit boards 11 and the part which 17 should carry out electric conduction fixing certainly fix also after fixing, dependability is securable.

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[Translation done.]